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Donald F. Huelke

PRACTICAL DEFENSE PROBLEMS—THE EXPERT'S VIEW

DONALD F. HUELKE*

INTRODUCTION

Many reports are available to document the effectiveness of seat belts.[1] The evidence is overwhelming that lap and shoulder belts are effective in reducing the severity of crash injuries. Data collected indicate a 35-90% reduction in serious and fatal injuries when belts are used.[2] An extensive study has shown that car occupants not using seat belts are more than four times as likely to be killed as those using seat belts; unbelted front seat occupants were found to be more than

*B.S., M.S., University of Illinois; Ph.D., University of Michigan; Professor of Anatomy, University of Michigan. Dr. Huelke is a member of numerous professional societies, including the American Association of Anatomists, the American Association of Automotive Medicine, and the American Association of Physical Anthropologists; he is a Fellow of the American Academy of Forensic Sciences. He has served as a consultant to the Ford Motor Company, General Motors Corporation, the National Highway Safety Bureau, and several law enforcement agencies. He has received numerous awards for his research in automobile accident and injury prevention. Dr. Huelke has written, alone or jointly, over 70 scholarly articles, books, and chapters of books. He has had extensive experience working with attorneys as an expert witness.

[1] See the article by Robert H. Snyder, *infra* page 211; Huelke & Gikas, Causes of Deaths in Automobile Accidents (Final Report, ORA Project No. 06749, University of Michigan, 1966) [hereinafter cited as Huelke & Gikas]; Tourin & Garrett, Safety Belt Effectiveness in Rural California Automotive Accidents (Automotive Crash Injury [ACIR], Cornell University, 1970) [hereinafter cited as Tourin & Garrett]; Schwimmer & Wolf, Leading Causes of Injury in Automobile Accidents (Automotive Crash Injury Research [ACIR], Cornell University, 1962) [hereinafter cited as Schwimmer & Wolf]; Lister & Milsom, *Car Seat Belts: An Analysis of the Injuries Sustained by Car Occupants,* 191 PRACTITIONER 332 (1963); Huelke & Gikas, Election—The Leading Cause of Death in Automobile Accidents, Proceedings, 10th Stapp Car Crash Conference 156 (1966); Vulvan, *Review of the Relative Merits of Various Types of Motor Vehicle Seat Belts,* 2 J. AUSTRALIAN ROAD RESEARCH BD. 33 (1966); Wolf, *Control of Ejection in Automobile Accidents,* 158 J. AM. MEDICAL ASS'N 220 (1962); Campbell, *Role of the Safety Belt in 19 Auto Crashes,* 50 BULL. AM. COLLEGE OF SURGEONS 155 (1955); Campbell & Kihlberg, Seat Belt Effectiveness in the Non-Ejection Situation, Proceedings, 7th Stapp Car Crash Conference 177 (1965); Frazier, *Effectiveness of Seat Belts in Preventing Motor Vehicle Injuries,* 264 NEW ENGLAND MEDICAL J. 1254 (1961); Fredericks, Barrier Collision Investigation of Harness Restraining Systems, Proceedings, 7th Stapp Car Crash Conference 1 (1965); Ganslen, Human Tolerances to Automatic Restraint Harness Activator Forces, Proceedings, 9th Stapp Car Crash Conference 13 (1966); Gikas & Huelke, *Causes of Death in Automobile Accidents—Can Seat Belts Really Save Lives?* 63 J. MICH. STATE MEDICAL SOC'Y 351 (1964) [hereinafter cited as Gikas & Huelke]; Lindgren & Warg, *Seat Belts and Accident Prevention,* 188 PRACTITIONER 467 (1962); Tourin, *Ejection and Automobile Fatalities,* 73 PUB. HEALTH REP. 381 (1958) [hereinafter cited as Tourin]; Huelke & Gikas, Determination of Seat Belt Effectiveness for Survival in Highway Collisions, Proceedings, 7th Stapp Car Crash Conference 403 (1965) [hereinafter cited as Determination of Seat Belt Effectiveness]; Bohlin, A Statistical Analysis of 28,000 Accident Cases With Emphasis on Occupant Restraint Value, Proceedings, 11th Stapp Car Crash Conference 299 (1967).

[2] Huelke & Gikas, *supra* note 1; Tourin & Garrett, *supra* note 1.

five times as likely to be killed than belt wearers.[3] In a study of similar crashes, unbelted occupants were injured more frequently and more severely than the belted ones; it was shown that failure to use seat belts increased the risk of injury by 100% in cases of immediate death or severe injury, by 70% in the "more than trivial injury" category, and by 40% in cases of any injury.[4] Reporting a variety of program items to prevent or minimize motor vehicle injuries, the United States Department of Health, Education and Welfare showed that increased seat belt use has the highest benefit-cost ratio.[5]

As the brakes are incorporated in the car to slow down the vehicle, safety belts are also an integral part of the car and similarly act on the occupants. Both brakes and safety belts require participation on the part of the occupant to be effective. A seat belt system properly installed and properly worn still offers the single best protection for the automotive occupant during an impact.[6] Although seat belts have been pinpointed in the medical literature as a potential source of injury, many occupants would have been more critically injured if belts had not been worn.[7] It has been indicated that seat belts as such do not present a hazard. Injuries which some observers have associated with seat belts are more properly associated with such factors as accident type and speed at impact, with the occupants being better off with seat belts than without.[8]

The generic term "seat belt" includes both the lap belt and upper torso restraint, the shoulder belt. Some cars are equipped with a "three-point" belt system, i.e., the lap and shoulder belt together attach to one common location. More frequently, however, the lap belt has a separate attachment from that of the shoulder belt. Most shoulder belts pass diagonally across the chest from the outboard shoulder area to the inboard hip region.

In passenger cars manufactured after January 1, 1968, shoulder belts are standard equipment for the driver and front right passenger. Use of the shoulder belt along with the lap belt offers a significant amount of protection beyond that offered by the lap belt alone. In forward force collisions the occupant may flex over the lap belt to strike the steering wheel, the instrument panel, the sunvisor area, the rear

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[3] HIGHWAY SAFETY FOUNDATION, A STUDY OF SEAT RESTRAINT USE AND EFFECTIVENESS IN TRAFFIC ACCIDENTS (1970).

[4] Kihlberg, Efficacy of Seat Belts in Injury and Non-Injury Crashes in Rural Utah (Cornell Aeronautical Laboratory, Inc., Report No. VJ-27721-R3, 1969).

[5] U.S. DEP'T OF HEALTH, EDUCATION & WELFARE, MOTOR VEHICLE INJURY PREVENTION PROGRAM (1966).

[6] See the article by Robert H. Snyder, *infra* page 211; *see also* Snyder, *Seat Belt Injuries in Impact,* in THE PREVENTION OF HIGHWAY INJURIES (Selzer, Gikas & Huelke eds. 1967).

[7] Schneider, *et al., Lap Seat Belt Injuries: The Treatment of the Fortunate Survivor,* 67 MICH. MEDICINE 171 (1968).

[8] Garrett & Braunstein, *The Seat Belt Syndrome,* 2 J. TRAUMA 222 (1962).

view mirror, the side or top of the windshield frame, or (in the case of rear occupants) those structures directly in front or to the side. When the shoulder belt is used, these areas cannot be impacted by the occupant unless there is a collapse of these structures into the compartment, as can occur in high speed collisions. In such cases, serious fatal injuries would be expected even if restraint systems had not been used.

In any crash there are generally two collisions, that of the vehicle with some other object and the collision of the occupant with some interior car component.

Aggravated Second Collision Injuries

Ejection of the occupant from the vehicle has been shown to be one of the leading causes of death to automobile occupants.[9] Not infrequently, especially in rollover accidents, the passenger compartment is relatively intact, yet death or serious injury of the occupant occurs because of ejection through an open door. In the new model cars the frequency of door openings, along with the hazard of ejection, has been markedly reduced.[10] However, cases are now being found where the occupant is ejected through the side window opening or even through the door window glass. These are classic examples of where safety belts can be most effective.

In one such case, a vehicle traveling at a high rate of speed missed a right curve, went off the road and flipped and rolled for some 200 feet. The front passenger was ejected through the right door window and was killed when he struck a farmhouse foundation. The other three occupants remained in the car and sustained only minor injuries.

The occupant may be totally or partially ejected from the car. When totally ejected, serious or fatal injuries are sustained by violent contact with the roadway, ground, roadside trees, signposts or bridge pillars. In some cases the victim's own car or another vehicle will cause additional injuries when it rolls onto him. If partially ejected, the occupant's injuries are often sustained by the victim being crushed between the ground and the car. Seat belts prevent ejection; their use can eliminate those injuries directly attributed to the occupant ejection injury mechanisms mentioned above.

When the passenger compartment of the car is relatively intact—that is, the occupant area is not compromised by vehicle crush—there is then "survival space." In such a case, the seat belt and/or shoulder belt can be most effective in preventing serious injury or death, or can be the single most effective factor in reducing the severity of injuries. As the car decelerates in a collision, so too will the occupants.

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[9] Huelke & Gikas, *supra* note 1; Tourin & Garrett, *supra* note 1; Schwimmer & Wolf, *supra* note 1; Gikas & Huelke, *supra* note 1; Determination of Seat-Belt Effectiveness, *supra* note 1; Tourin, *supra* note 1.

[10] Schwimmer & Wolf, *supra* note 1.

Without restraint systems the occupants will crash into a variety of interior structures, often with a violence exceeding the human tolerance levels, thereby sustaining significant injuries. A restraint system will decrease or attenuate the occupant collision forces and aggravated injuries will not be sustained. A restraint system will aid in directing the occupant into designed force attenuating systems, such as the energy absorbing steering wheel-column system and the impact dissipating padded instrument panel, rather than allowing the occupant to strike some other area of the car or to be ejected.

In-car occupant displacement usually occurs in a collision. This may take the form of a driver being jarred from his location following a minor collision, allowing the vehicle to continue out of control and possibly become involved in a more serious crash. However, injuries caused directly by occupant displacement are more common. An occupant may be catapulted to the far side of the car where the opposite door interior, A-pillar; or instrument panel can be struck. These are frequently the locations of injury production.

There have been cases of right front collisions, for example, in which the unbelted driver was catapulted toward the right front of the passenger compartment, striking his head against the right windshield frame (the A-pillar), the opposite door, the instrument panel or even other occupants. Obviously, this type of occupant displacement could be prevented by the use of restraint systems and in many such cases serious or fatal injuries would not occur. In one case, a young man, accelerating on a bumpy blacktop road, lost control of his car. The vehicle began sliding sideways off the road and struck a tree at the right front wheel. The unbelted driver catapulted toward the right A-pillar of the windshield, where he sustained fatal head injuries. No crush of the occupant compartment was noted—had he worn the available lap belt he would have survived.

Investigation by the Seat Belt Expert

The seat belt defense expert is specifically concerned with the kinematics of body motion in the crash, i.e., how the unrestrained occupant moved during and after the crash and what objects inflicted the injuries. Information is usually not gathered solely from the crash site, but also from the case vehicle inspection or photographs taken in connection with the inspection. The other sources consulted include the occupant injury description, police reports, and statements of police, witnesses, the claimant or others involved in the accident.

The Crash Scene

Hardly ever does an experienced accident investigator have the opportunity to be on the scene of the accident before the vehicle(s) has been moved. Only a few such scientific field accident teams are called

to accident scenes by the police. Most crash scene investigations are conducted by the police. Therefore, police accident reports, observations, and photographs (along with witness statements) are the most reliable data sources, although gross errors have been found in some reports. Sometimes pertinent information about the crash—such as skid marks and gouge marks—are still obvious for several days following the crash. However, only in rare instances does an immediate on-site investigation need to be made. At the scene of a serious injury-producing crash it is difficult to obtain data, for many other activities are occurring simultaneously. Officers with traffic control problems, ambulance crews, wrecker crews, and associated vehicles all tend to clutter the scene and cause confusion. The experienced field accident investigator has sufficient expertise so that an immediate on-site investigation is not usually required. Nevertheless, the expert should view the location of the accident if possible, especially if it is in a rural area where terrain variations may be more significant than in an urban setting.

In many potential seat belt defense cases, the crash site is probably the least important of the various pieces of information. In some cases, photographs taken of the vehicles at the crash site are useful in understanding the path of travel of the vehicle prior to collision which might have influenced the occupant's position at the time of impact.

THE VEHICLE

Inspection of the vehicle not only allows the expert to determine the location and direction of the impact by a study of the external damage to the car, but also allows him to detail the major occupant impact site within the car. Injury sources can be pinpointed by such evidence as clothing imprints, tissue remnants or permanent deformation of interior structures from occupant impact.[11] Combining these facts with knowledge of the specific type of injuries that occurred, the expert can detail the occupant's trajectory (path of body travel). In those cases where there are several occupants in the case vehicle at the time of impact, their paths of body travel and subsequent impact areas can also be detailed.

In one case, two young men were traveling together at night when their car left the roadway and struck a tree at the left front of the vehicle. Neither would admit to being the driver. Injury descriptions of both occupants were obtained and the vehicle inspected. There was crush damage to the center of the instrument panel. Tissue remnants and knee imprints with cloth scuff marks were noted on the lower instrument panel. Knee and facial injuries of one occupant matched the

[11] Huelke & Gikas, *Investigations of Fatal Automobile Accidents From the Forensic Point of View*, 11 J. FORENSIC SCIENCES No. 4 (1966).

vehicle interior damage; the other occupant was determined to be the driver by lack of facial injuries.

In some cases only photographs from police or other sources are available (the car being junked before any detailed investigation can be made). Using these photos of both the exterior and interior of the car, the expert can usually determine the path of body travel and the sources of impact inquries. Probably the most reliable, or the least ambiguous, sources of information on occupant trajectory and vehicle motion at impact are the injury pattern and the evidence of occupant interior impact.

The Claimant

Injury descriptions, when available from the occupants themselves, should be substantiated from emergency room or hospital reports or private physician examinations. In the case of a fatality, such descriptions should be substantiated from the autopsy report or the injuries listed by the medical examiner or coroner. In some cases the police who were at the scene or the ambulance attendants will be able to fill in some injury descriptions. The seat belt expert can also be of aid to the defense attorney by reading the depositions of the various parties involved, especially that of the claimant. Often the attorney who took the deposition has not asked certain significant questions concerning a variety of areas directly related to the case. The expert can assist the defense attorney by aiding in developing a set of questions to cover these ommitted areas.

Analyzing the Evidence

Injury descriptions are always necessary. It is on the basis of these that a possible seat belt defense is established. In addition to this medical information the seat belt defense expert needs data from at least one of the following sources: the police reports and photographs; the vehicle itself; and depositions or other statements of the occupant(s) or of witnesses. Often police reports, photographs and statements are repetitious, not providing additional information but corroborating each other.

The crucial question in a seat belt defense case is: "Would the claimant have sustained the injuries to his . . . (here one or more specific body areas are stated) if he had worn a seat belt?" This is not a question as to the total elimination of occupant injuries; it relates to injury reduction or injury avoidance with respect to a specific body area. Sometimes there will be injury "trade-off" with the use of a seat belt. For example, the occupant using the lap seat belt may possibly sustain a distraction fracture in the lumbar area of his back as a result of a specific accident. But an unbelted occupant involved in an identical accident, because of the crash dynamics and body trajec-

tory,would strike his head on the opposite side of the car interior, sustaining severe, permanent brain damage. Thus, in some cases use of the seat belt does not necessarly eliminate all injuries. It prevents or reduces serious injuries to a specific body area or even transfers an injury from one region to a less vulnerable body region, thereby reducing the injury severity level to one of a less serious nature.

If, however, the seat belt defense consultant cannot show in his occupant injury reconstruction that injury reduction could have been achieved by the use of the lap belt, he should so inform the defense attorney immediately. Lap seat belts are less effective in cases where there is collapse and compromise of the occupant space, especially in head-on or side collisions. Even lap-shoulder belts will not offer significant protection in high speed impacts where severe crushing of the occupant compartment is noted.

Development and Presentation of Evidence

Most jurors do not understand the concept of "path of body travel," i.e., the manner in which occupants move about in a car during a collision. In preparing for trial, the expert should first develop simple examples to illustrate occupant dynamics; more complex concepts of occupant dynamics can then be built on the initial simple explanations. The following basic example can be developed: If a car strikes a brick wall head-on, the car will stop in approximately a quarter of a second. The occupant continues to move in the direction that the car was traveling just before impact and at the same speed as the car. If unrestrained, he moves forward, striking objects in the car interior that are in front of him, such as the steering wheel, instrument panel or windshield. Another example that can then be used is the rear-end collision: When the vehicle is struck from the rear it is pushed forward, the occupants attempting, as it were, to move rearward. However, the seat back prevents such movement, except for the head. If unsupported by a head restraint (headrest), the head will snap backwards, often producing the cervical sprain syndrome (whiplash). To use another simple illustration, if a car is struck in the side, one or two dynamic actions occur to produce occupant movement: If the car is struck in the right side, the driver would essentially slide to the right, striking the interior of the right side of the passenger compartment; or the car may be literally pushed from beneath him so that right door occupant impact is made. Occasionally both dynamic actions may occur simultaneously, as when a car sliding broadside is struck by an oncoming vehicle.

Once this groundwork has been laid, more complex accident situations can then be described if necessary. The front angle collision is basically a combination of a head-on with a side collision. Rather than moving straight ahead or directly to the side, the unrestrained occupant

moves diagonally sideways. For example, if the impact is to the right front wheel-headlight area, the driver will strike the structures in front of and adjacent to the passenger area—the windshield, A-pillar, door or instrument panel. It is extremely important to distinguish between direct frontal but offset collisions, as opposed to those in which the contact force is angled, even though it may be on center.

Along with the above explanations or immediately following them, photographic documentation of actual crashes (best shown by color slides) can be presented for clarification. In this way, jurors can develop an understanding of the collision dynamics of the occupants' path of body travel. If movie films of planned crashes are available, these also can be used to educate the jury.

Oftentimes the jurors are overwhelmed by detailed medical testimony. They may have preconceived and incorrect ideas (or no knowledge) of the anatomy of the body area under consideration. If chest injury is in question, a brief description of the chest wall, including the lungs, heart, and other organs is often worthwhile. Visual aids, models, drawings, or a skeleton are useful. This testimony must be presented in a clear, simplified manner by someone well versed in anatomy.

Conclusion

The function of the expert in this area is to assist defense counsel in establishing the necessary facts to support the seat belt defense. The attorney must be able to rely on his expert's ability to gather and analyze the available evidence. He should work hand in hand with the expert in the development of the evidence for trial and its effective presentation at trial. The key to establishing a sound seat belt defense is in the attorney's efficient use of a competent expert who can aid the attorney at every step in the crucial process of fully elaborating the evidence necessary to support the defense.